



Search for biological control agents
of Hydrilla verticillata:
report on visits to Rwanda, Burundi
& Uganda, Feb-March 1983

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SEARCH FOR BIOLOGICAL CONTROL AGENTS OF HYDRILLA VERTICILLATA:

REPORT ON VISITS TO RWANDA, BURUNDI AND UGANDA, FEB-MARCH 1983

Introduction

Following the completion of the fruitless search for Hydrilla in Kenya, the survey is being extended to neighbouring countries along the lines suggested by Pemberton (1980) and in the CIBC Project Proposal.

Because of the lack of available information about the diverse waterways of Rwanda and Burundi, and the apparent absence of herbarium records of Hydrilla, a preliminary reconnaissance was felt to be necessary. This visit was planned for January 1983 to coincide with the short dry season; unfortunately, it had to be delayed for various administrative reasons, but a two-week visit (8-22 February) has now been completed.

Previous Hydrilla records from Uganda have come mainly from Lake Bunyoni in the South-West and from the Jinja area of Lake Victoria. The former site is currently inaccessible due to the poor security situation, but the latter was felt to be sufficiently safe to commence field work. A ten-day survey was therefore undertaken in early March (1-10th), based in Jinja but including an excursion to Lake Kioga.

In Burundi abundant sources of Hydrilla were found in Lake Tanganyika, within easy reach of Bujumbura; lakes Cyohoha and Rweru in the North of the country were not visited. In Rwanda the great diversity of aquatic systems could not be adequately covered in the short time available, especially as heavy rain had made travel towards the West and North of the country difficult. Hydrilla was not found at any of the sites visited in Rwanda, although conditions appear favourable in some parts of lake Kivu; waterways in the Akagera/Nile drainage system towards the East of the country appear less suitable.

In Uganda, several days of searching in Lake Victoria, around Jinja, failed to reveal an extant source of Hydrilla. An abundant growth of the plant was, however, found in a limited area of Lake Kioga, near to the inflow of the Victoria Nile.

It is proposed that a further visit should be made during the main dry season (June-July) to include lakes Bulera (N. Rwanda), and Rweru (Rwanda/Burundi border) and the South of Lake Kivu; a longer period should be spent at Bujumbura so that more collections of Hydrilla and associated organisms can be made. Proposals for Uganda are more difficult to formulate, given the continued uncertainty in the security situation; if possible, further collections of Hydrilla should be made in collaboration with local fisheries research biologists.

Burundi - Lake Tanganyika

Following his discovery of Hydrilla at localities on Lake Tanganyika near Kigoma in Tanzania, Pemberton suggested that the Burundi shore of the lake might well provide a suitable site for collecting natural enemies. The present visit confirmed this: a population of Hydrilla was found scarcely three kilometers from the centre of Bujumbura whilst the plant seems to be common along a stretch of shallow bays 16-21kms South of the city. Hydrilla appears to be absent from the next 50km of shore, which are steep and rocky, but local fishermen reported the presence of the plant again at Rumonge, 77km South of Bujumbura; unfortunately,

stormy weather prevented the boat search that would have been needed to confirm this, but the habitat looks suitable. In general, fishermen knew the plant and apparently attach some importance to it as a shelter for fish.

Hydrilla was found on gently shelving shores, with a muddy or sandy bottom, and in clear water, 1 to 1.5m deep. The plant formed in some places a thick carpet of tangled stems, covering the hyd⁵soil to a depth of c.50cm but not reaching the surface - even though some stems bore flowers; this situation is probably due to wave action which is severe at times. Stands of Hydrilla included a lesser amount of Vallisneria ?spiralis and Potamogeton ?pectinatus.

A single sample of Hydrilla (c. 3kg) was collected and this showed very little sign of damage of any kind. A careful search of the sample, assisted by local fisheries staff, yielded large numbers of aquatic snails (as yet undetermined) but no insects. A small sample of the plant was preserved alive, firstly to establish a culture under quarantine in Nairobi and secondly to serve as a model to show to fishermen and field staff in Rwanda.

With a view to possible longer-term work by CIBC or USDA staff, it may be said that in Burundi the attitude to foreign research workers appears quite positive. Both USAID staff (Mr H. Fisher) and the Peace Corps Director (Ms K. Tilford) suggested that a suitable worker would encounter no difficulties so long as they were attached to a Burundian institution and were seen to contribute something, either in materials or expertise, to the local development effort (sensu lato). The Director of Eaux et Forets (Mr Nyakageni), the Department under whose jurisdiction any such work would fall, is himself a hydrobiologist with a keen interest in research work; limited facilities are available, including a small laboratory and the use of a boat (when not required for other duties). Currently the possibilities for research are hampered by lack of trained staff, funds and equipment. Any project based in Burundi for an extended period should provide for an appropriate contribution to the host organisation in the form of literature and laboratory/field-collecting materials; technical supplies seem, in general, not to be available in Bujumbura.

The main obstacle to work in Burundi is the high cost of living and especially of transportation (car hire costs US \$70-75 per day, gasoline \$1.20 per litre). Most fisheries staff and all officials speak French, but most fishermen and villagers do not; these latter usually speak some ki-swahili.

Rwanda

Rwanda has a great variety of aquatic habitats. Most of the country is drained by an extensive network of rivers flowing eventually into Lake Victoria - and referred to loosely as the 'Nile drainage'. Many of these rivers are swiftly flowing and all are heavily laden with sediment. Within this system, more promising habitats exist in the many swamps that occupy flat valley bottoms, and in the lakes along the Akagera River to the East of the country (described below). There are also in this area numerous fish farms (now often derelict) and water supply dams; some of these are long-established and less charged with sediment and so potentially more promising.

Without enumerating individual sites, it may suffice to say that none of the many ponds visited (from Kayonzo in the East, via Kigali and Gitarama, to Butare in the South) supported a well developed submersed flora. In individual ponds there were abundant growths of Nymphaea spp., sometimes accompanied by Ceratophyllum demersum and Aponogeton sp., and in two cases a quantity of Chara sp.; however, no Hydrilla or related plants were found

The Akagera river system seems to comprise at least three quite different aquatic environments. The river itself is moderately swift-flowing, sediment laden and c.16m deep, the banks fringed with floating mats of Cyperus papyrus - altogether quite unsuitable for rooted submersed aquatics. Alongside the river are extensive swamps, partially floating, and cut by channels 1-3m deep; the water in these channels was very clear, somewhat dark-tinted, and, judging by the poor growth of Nymphaea and Pistia in them, probably very low in nutrients. The third component is provided by the lakes - of which only Ihema was visited: this lake is turbid, mainly due to abundant phytoplankton, 6-7m deep, and supports a major fishery project (based on Tilapia and Clarias); the shores are mainly gently shelving, muddy or sandy, fringed with Aeschynomene elaphroxylon on the landward shore and with C. papyrus along the course of the Akagera river.

Emerse aquatics such as Hydrocotyle and Ludwigia are abundant in the swamps and along the Akagera river. The only submersed aquatic found was Utricularia ?inflexa, but both local fishermen and the fisheries specialist in charge of the Pecherie Ihema (Vincent Frank) reported at times having seen other aquatics in the swamp channels; it was suggested that increased flow later in the wet season might improve the nutrient status of these waters and promote plant growth. No submersed plants were found in the main lake - possibly they are discouraged by the abundant hippos, causing physical damage, and the phytophagous Tilapia rendalli, which is also quite common.

Lake Kivu, in complete contrast, is deep and very clear. Along most of the shore visited (a stretch of c.40km from Kibuye southwards) mountains plunge straight into the lake forming steep, rocky shores with numerous long sheltered inlets. At the head of most of these inlets there are stream inflows, providing shallow areas with sand or mud bottoms, potentially suitable for aquatic plants.

Only one totally submersed plant was found, a small Potamogeton, and that only at one locality. Many shores were fringed with a sedge which forms abundant submersed leaves during its early growth stages. It seems likely that the abundant and diverse cichlid fauna of the lake contributes to the paucity of aquatic vegetation. Local fishermen claimed to recognise samples of Hydrilla, but seemingly only from stranded fragments; they proved unable to provide examples during a day's search. Fisheries biologists and others reported that the northern part of the lake, near Gisenyi, is totally devoid of aquatic macrophytes, but that the area of Cyangugu, at the southern end of the lake, is more fertile. A visit to this latter region would seem worthwhile if it can be combined with a second visit to Burundi.

Uganda - Lakes Victoria and Kioga

Because of the vast potential area of search, the survey of Lakes Victoria and Kioga had to depend heavily on local information. Initially contact was established with the Uganda Fresh-water Fisheries Research Organisation; members of staff arranged for the hire of a boat and engine, took part in most of the lake searches and altogether provided invaluable support. On arrival in Jinja, visits were made by road and boat to settlements and fish landing beaches on Lake Victoria. Fishermen were shown samples of the plant and offered cash incentives for firm information and locally collected samples. Specific reports were followed up by boat searches, if possible taking the informant as guide.

Almost without exception, fishermen claimed to have seen Hydrilla, but most reported that it was found in deep water and only brought up by chance in nets. Many hours were spent checking out apparently precise reports of the plant in accessible sites, such as swamps and shallow inlets, but all proved fruitless. Unfortunately, lack of a suitably 'seaworthy' boat prevented me from following up persistent reports that Hydrilla could be found at 'Lingera', an area near Buvuma Island, well off shore. However, it is hoped that local people will eventually bring in samples, if the plant can indeed be found there.

The Jinja area of Lake Victoria is remarkable for the clarity of the water and the diversity of the shore line - including various kinds of swamps, muddy, sandy and rocky shores and different degrees of exposure to wave action. However, perhaps more remarkable is the seemingly complete absence of a submerse flora; a few stands of Trapa and occasional plants of Pistia, both in the channel leading to the Head of the Nile, were the only truly aquatic plants encountered. It may be significant that the previous Hydrilla records all date from before the closing of the Owen Falls Dam (which resulted in a marked rise in the water level) and before the explosive spread of introduced Tilapia species (which included the phytophagous T. rendalli/T. zillii).

A visit was made by road to the Terinyi Ferry (now a bridge) where the Mpologoma river, flowing into Lake Kioga, passes through extensive swamps. The water carried a heavy sediment burden but supported luxuriant beds of Ceratophyllum, Utricularia, Nymphaea Ludwigia and Hydrocotyle.

Finally, a search was made of part of Lake Kioga, based at the important fish-landing of Bukungu. Earlier fisheries department reports indicate that Kioga was previously much shallower and completely carpeted with aquatic plants. Submerse plants are now seemingly limited to a shallow area, previously an island, next to the inflow of the Victoria Nile, which presumably deposited these sediments as a levée, and to the margin of nearby swamps. This is also the area where most of the fishing is done and so the nets of fishermen landing at Bukungu were full of fragments of aquatic plants. The clarity of the water and the plankton composition (UFFRO, pers. comm.) indicate that this area is influenced mainly by the flow from lake Victoria, rather than by that from the eastern end of Lake Kioga.

The water in the plant-rich area is 1.7-2.0m deep, with a fine mud or silt bottom. Weed beds are marked at the surface by leaves of Nymphaea sp. and Potamogeton ?schweinfurthii; however, in biomass terms, Lagarosiphon sp. is probably the dominant plant with smaller quantities of Najas, Ceratophyllum, Vallisneria and Hydrilla. Occasional strands of both Lagarosiphon and Hydrilla approach the surface, but flowers were not found. The Ceratophyllum and Najas both showed a remarkably compact growth form and neither approached the surface. In the swamp margin habitat, Ceratophyllum and Najas appeared dominant, with some Lagarosiphon and Vallisneria, little Potamogeton but seemingly no Hydrilla.

Substantial samples of most plants were collected with a drag-rake, but the mixed stands of plants made it difficult to associate the fauna collected with a particular host. Gastropods were extremely abundant but insects of all kinds were very few. Pyralid larvae, presumably Nymphula, were collected from Potamogeton, Najas and Ceratophyllum and a single specimen from Lagarosiphon, but none from the Hydrilla. In general, the Lagarosiphon and Hydrilla showed little sign of damage; however, some older strands of the latter had 'bunch-tops' followed by normal regrowth of subapical shoots, suggesting previous tip-damage.

From the biological point of view, Bukungu would be an excellent study site. However, the village offers no facilities: for security it is necessary to camp next to the police station in the main square, there is of course no power or piped water, and the village is only accessible by a rather poor road (which is cut in wet weather). More importantly, the security situation in the area remains very uncertain. Certainly it would seem unwise to try to base a long-term study at this site. Because of the importance of the Kioga fisheries, UFFRO staff are planning to re-start field work on the lake. If some support could be given to their programme, it may be possible to arrange for them to make further collections of Hydrilla, with or without the assistance of CIBC staff.

The UFFRO laboratories in Jinja are substantial and basically well equipped, though now very short of 'consumable' supplies (chemicals, glass-ware etc.) and transport (both vehicles and boats). Jinja for the moment seems tolerably safe, at least by day, but accomodation would present problems on a longer visit. Further studies could be made in the area, especially if a more accessible source of Hydrilla can be identified, but conditions are far from ideal.

Taxonomy

Small dried fragments of plants from both Kioga and Tanganyika have been sent to Dr Pieterse of the Royal Tropical Institute, Amsterdam. He believes the samples to be Hydrilla, similar to that previously collected from Lake Tanganyika, but different from his other material. The material from Burundi appears rather different from that from Uganda, the latter being more robust, with more 'triangular' and sharply pointed leaves, bearing soft 'spines' on the underside of the mid-rib; these differences have so far persisted in laboratory culture. Living samples are being sent to Amsterdam for iso-enzyme studies.

Conclusions and Recommendations

1. During the Current Year (to September 1983):

a) Uganda. Explore the possibility of obtaining further material and data from Kioga, in collaboration with UFFRO, Jinja.

b) Burundi. Make a further visit to Bujumbura during the main dry season (June) to collect from as many sites as possible on Lake Tanganyika; visit Lake Rweru (N. Burundi).

c) Rwanda. Visit Lake Bulera (N. Rwanda) and Cyangugu (Lake Kivu, S.W. Rwanda).

The possibility of further work in Uganda will have to be continually assessed in the light of the changing security situation.

To enable the objectives of b) and c) to be combined, it is suggested that the next mission would start in Kigali where a vehicle would be hired; after a short visit to N. Rwanda (Bulera), the investigator should travel South by road, via Cyangugu (Kivu) and Kitundo (Rweru and Gohoba) to Bujumbura (L. Tanganyika). There are apparently no obstacles to moving vehicles between Rwanda and Burundi. The route proposed, as well as covering all the desired sites, would avoid the considerable difficulties of obtaining transport in Burundi.

Any natural enemies collected would be brought back to Vairobi for study. Cultures of Hydrilla are now well established under quarantine at Muguga.

2. Possible Extension of Project

Following the considerable expenditure of time and money already made on Hydrilla searches in East Africa, it would seem most inappropriate to terminate this project in September 1983; sources of Hydrilla have now been found and substantive progress may now be anticipated. Whilst it is understood that difficulties may be encountered in obtaining a further extension of the project period, it is felt that this could be justified in terms of the special logistic and technical problems previously encountered and because these have now been largely overcome.

It is assumed that a further year of activity on this project could be sustained out of funds already allocated.

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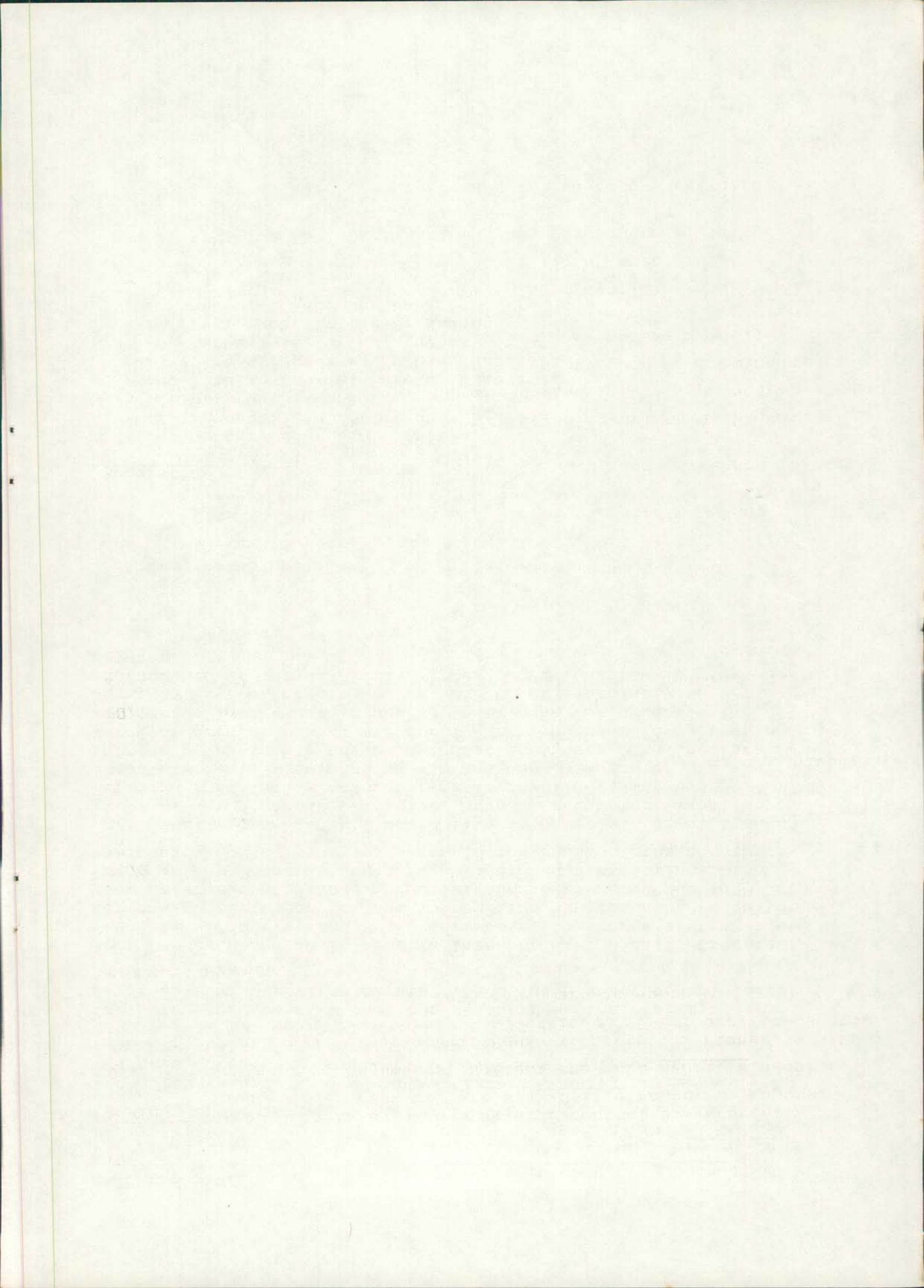
In Rwanda, I would like to thank Mr R.P. Biroli, Directeur des Eaux et Forets, and Mr J. Ruremesha, in charge of fisheries, for their helpful advice and information, introducing me to the many waterways of Rwanda. Special thanks are also due to Mr V. Frank of the Pecherie Ihema for his generous assistance with searches of Lake Ihema and sites in the South of the country.

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Circulation

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A.W. Kudhogania, UFFRO, Uganda
V. Frank, Pecherie Ihema, Rwanda
S. Mungoma, UFFRO, Uganda



Appendix - Outline Schedule: Burundi, Rwanda and Uganda

- 8/2/83 Nairobi-Kigali-Bujumbura by air; contact B.Nyakageni, %
Directeur des Eaux et Forets; Hydrilla found, Bujumbura.
- 9/2 Lake search, Bujumbura; collect and sort Hydrilla samples.
- 10/2 Discussions, B.Nyakageni, Eaux et Forets, H. Fisher, USAID,
K.Tilford, Peace Corps, & A.Autrique, ISABU; arr. transport.
- 11/2 Survey lake shore by road southward to Rumonge.
- 12/2 Arrange for return visit; Bujumbura-Kigali by air.
- 13/2 (Sunday) Paperwork & background reading.
- 14/2 Discussions: J.Ruremesha, i/c fisheries, Eaux et Forets, J.
Olsen, USAID; contact OTPN; to Lake Ihema by road.
- 15/2 Pecherie Ihema; discussion: V. Frank, i/c Pecherie;
boat search of lake and part of Akagera river.
- 16/2 By road Ihema-Kigali-Butare-Gisagara, searching en route.
- 17/2 ISAR for herbarium records; return to Ihema; search dams.
- 18/2 Ihema to Kigali; arrange car hire; Kigali-Kibuye (L. Kivu).
- 19/2 Search lake shore, Kibuye southward, by road.
- 20/2 Search Kibuye area; prepare plant specimens.
- 21/2 Interview fishermen, further searches; Kibuye-Kigali.
- 22/2 Discussion: R.P.Biroli, Directeur des Eaux et Forets;
Kigali-Nairobi by air.
- 28/2 Preparations at Muguga; Nairobi-Eldoret by road.
- 1/3 Eldoret-Malaba(frontier)-Jinja by road.
- 2/3 Discussions: A.Kudhogania, Director, & staff, UFFRO;
visit Masese fish landing by road; arrange boat hire.
- 3/3 Boat search, far shore of Jinja inlet and off-shore island;
return to Masese by road.
- 4/3 Boat search, swamps near Masese; discussions at UFFRO.
- 5/3 Road visit to Buluba and Bugadi landings, S. Busoga.
- 6/3 Road visit to Terinyi, Kioga swamps; prepare specimens.
- 7/3 Preparations, visit to District Commissioners etc.;
by road to Bukungu, Lake Kioga.
- 8/3 Boat search of Lake Kioga; collect Hydrilla etc.
- 9/3 Sorting plant samples, preparation of specimens.
- 10/3 Complete lab work; arrangements for return visit;
Jinja-Malaba-Eldoret by road.
- 11/3 Eldoret-Nairobi by road; set up laboratory cultures.

